

AMENDMENTS TO THE CLAIMS:

1-38. (Canceled)

39. (New) A variable speed drive circuit for an electric submersible pump system comprising a pump and a motor for driving the pump, the drive circuit comprising:

variable voltage supply means for supplying a voltage that can be varied as required;

inverter means supplied by said voltage for producing modulated waveforms that switch between an upper voltage level and a lower voltage level;

drive means for operating the inverter means to generate cyclically varying waveforms for driving a plurality of phases of the motor, the drive means being operable to produce overmodulation in which the modulated waveforms incorporate regions in which the voltage is non-linearly modulated such that each modulated waveform has extended periods at the upper voltage level and at the lower voltage level; and

speed control means for controlling the speed of the motor by varying said voltage supplied by the supply means to the inverter means.

40. (New) The drive circuit of claim 39, wherein the drive circuit is adapted to drive all of the phases of the motor simultaneously.

41. (New) The drive circuit of claim 39, wherein at lower speeds the speed control means is arranged to control the drive means according to a low speed control mode in which the waveform is linearly modulated.

42. (New) The drive circuit of claim 39, wherein the drive means is adapted to apply pulse width modulation.

43. (New) The drive circuit of claim 39, wherein the variable voltage supply means comprises chopper means for chopping a fixed voltage in a variable time-dependent sequence in order to supply said voltage.

44. (New) The drive circuit of claim 43, wherein the chopper means comprises:
capacitance means connected to first and second fixed supply voltage sources;
and
selection means for selectively supplying the voltage defined by the first and
second fixed supply voltage sources.
45. (New) The drive circuit of claim 44, wherein the chopper means is adapted to
vary the duty cycle of the selection means to adjust the voltage across the capacitance
means.
46. (New) The drive circuit of claim 39, wherein the variable voltage supply means
comprises a poly-phase boost converter adapted to supply the difference between the
upper voltage level and the lower voltage level from a poly-phase supply.
47. (New) The drive circuit of claim 39, wherein the variable voltage supply means is
adapted to vary its internal frequency with output so as to improve efficiency.
48. (New) The drive circuit of claim 39, wherein the drive means comprises
transformer means having a first secondary winding constituting a first fixed supply
voltage source and a second secondary winding constituting a second fixed supply
voltage source.
49. (New) The drive circuit of claim 39, wherein filter means are connected to the
inverter means so as to smooth out the transitions between the upper voltage level and
the lower voltage level.
50. (New) The drive circuit of claim 49, wherein the filter means are adapted to
supply substantially sinusoidally varying voltages to the motor.

51. (New) The drive circuit of claim 39, further comprising:

- means for varying the drive current or voltage supplied to drive the motor with a fixed load while the motor is driven at a fixed speed;
- means for monitoring the output power of the circuit during such variation of the drive current or voltage in order to determine the minimum output power required to drive the motor at said fixed speed; and
- means for controlling the output power of the circuit in order to minimize the output power of the circuit required to drive the motor at said fixed speed.

52. (New) The drive circuit of claim 39, for controlling driving of a permanent magnet motor, further comprising:

- means for varying, relative to an estimated rotor position of the motor, the phase of the drive current or voltage supplied by the circuit to drive the motor while said current or voltage is held at a fixed amplitude;
- means for monitoring the motor speed during such variation of the drive current or voltage in order to determine the maximum speed at which the motor can be driven by the available output power; and
- means for controlling the phase of the drive current or voltage in order to maximize the motor speed.